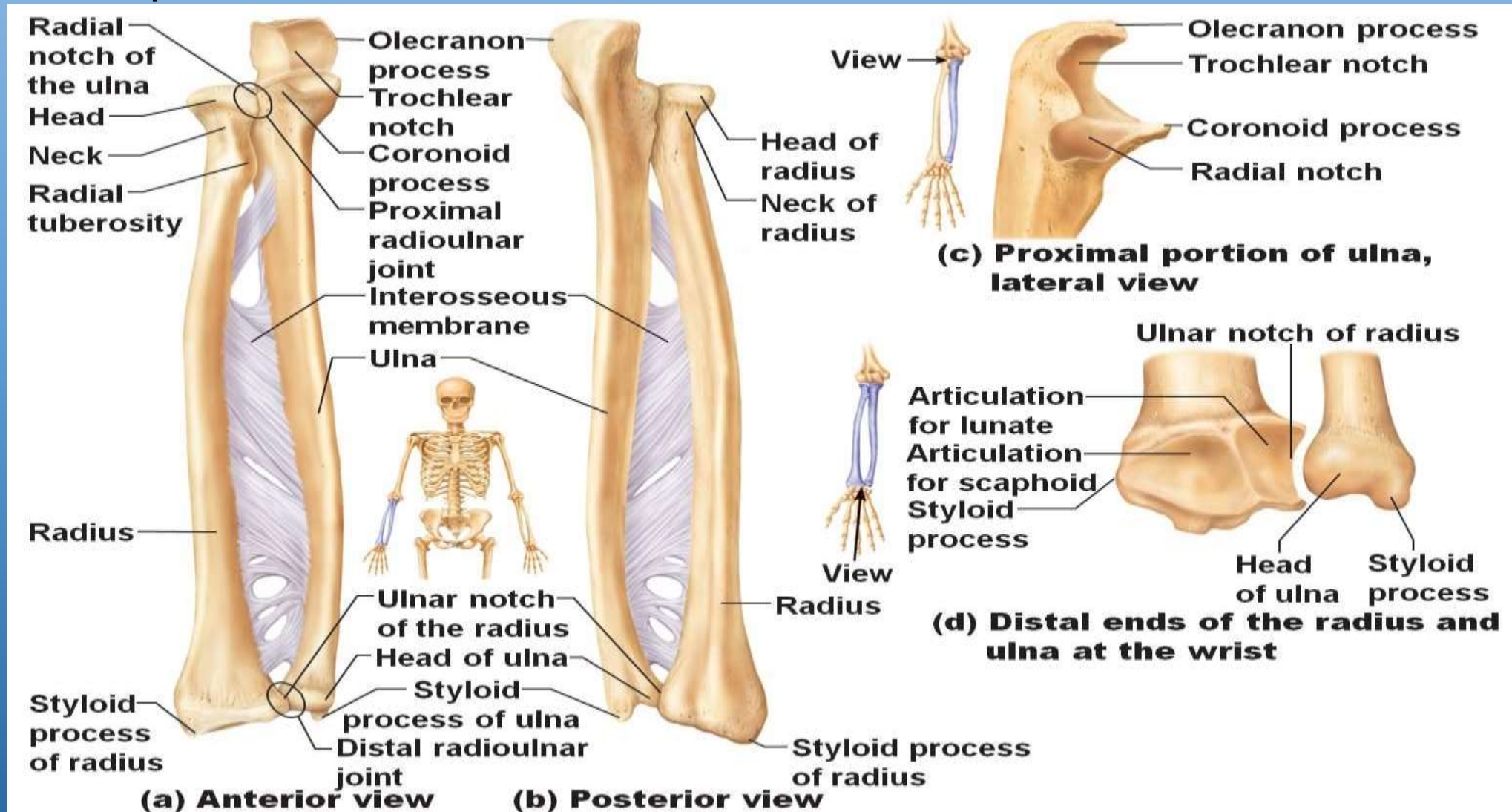


Forearm

Anatomy

- The radius and ulna have an important role in positioning the hand. The ulna has a stabilising role, while the radius is articulated in a way which allows it to roll over the ulna, moving the hand from supination (external rotation) to pronation (internal rotation)
 - The two bones of the forearm are the radius, laterally, and the ulna, medially. Other components of the forearm include skin, blood vessels, and soft tissue
 - At its upper end, the radius articulates with the capitulum of the humerus at the elbow, and with the ulna (superior radioulnar joint). At its lower end it articulates with the scaphoid and lunate bones and also with the ulna (inferior radioulnar joint)
 - At its upper end, the ulna articulates with the trochlea of the humerus, and with the head of the radius (superior radioulnar joint).

- The olecranon process at the upper end of the ulna forms the prominence of the elbow. The styloid process of the radius, prominences at the wrist



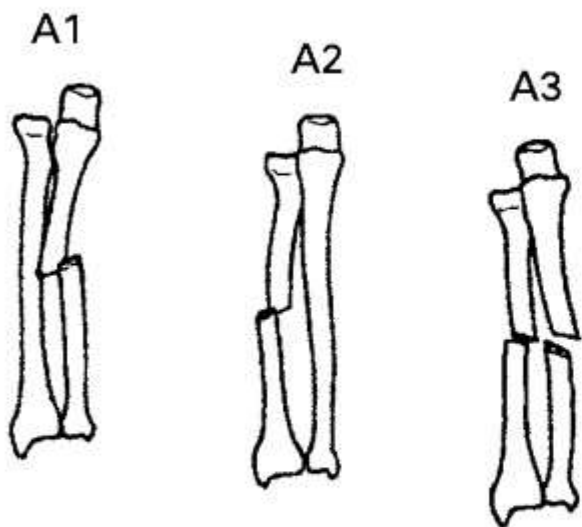
Classification

- Forearm fractures can be classified as either proximal, middle or distal.
- They can affect one or both forearm bones.
- They are either open or closed.
- Proximal forearm fractures may involve the elbow joint
- Distal forearm fractures may involve the wrist

- OTA classification
 - radial and ulna diaphyseal fractures
 - Type A
 - simple fracture of ulna (A₁), radius (A₂), or both bones (A₃)
 - Type B
 - wedge fracture of ulna (B₁), radius (B₂), or both bones (B₃)
 - Type C
 - complex

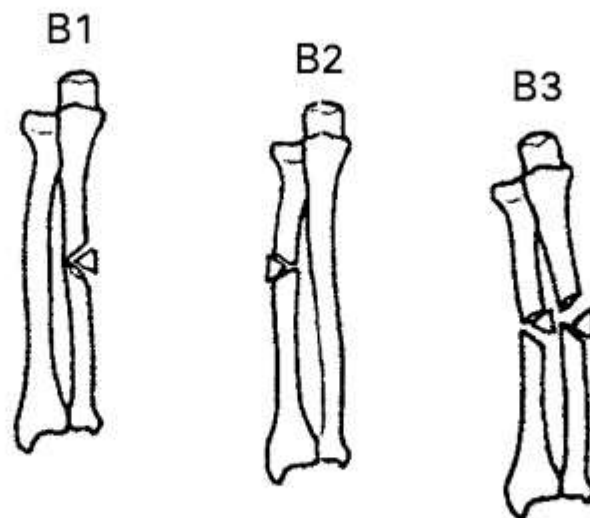
22- Radius/Ulna diaphysis

22-A Simple fracture



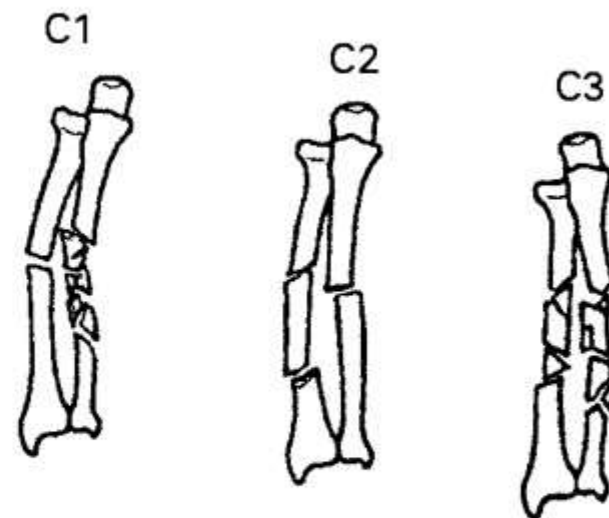
- 22-A1 of ulna, radius intact
22-A2 of radius, ulna intact
22-A3 of both bones

22-B Wedge fracture



- 22-B1 of ulna, radius intact
22-B2 of radius, ulna intact
22-B3 of one bone wedge, the other simple or wedge

22-C Complex fracture

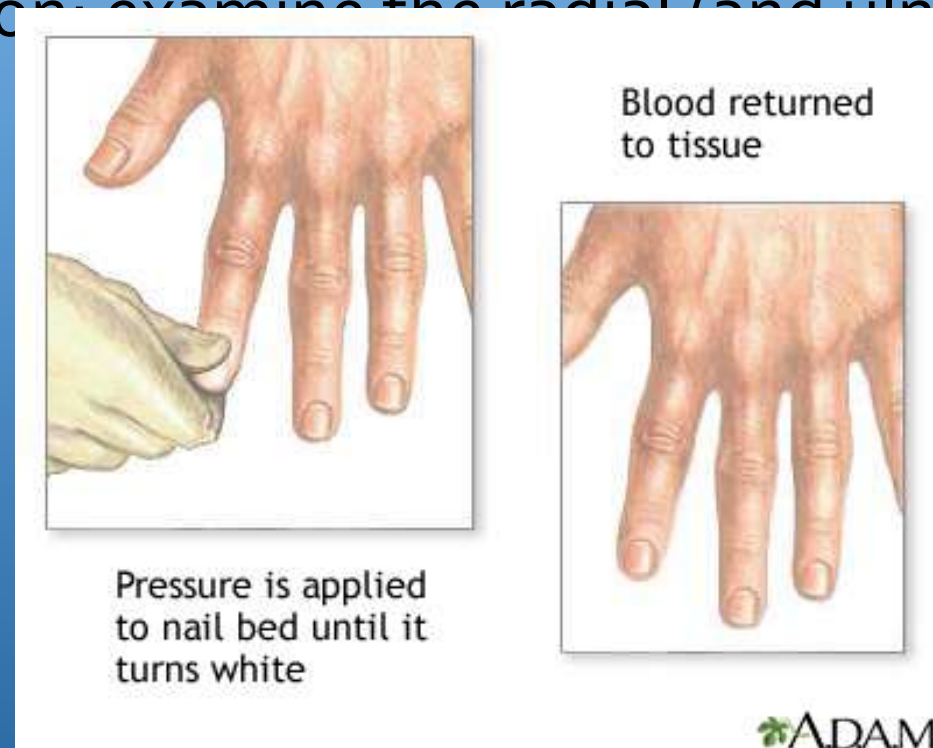


- 22-C1 of ulna
22-C2 of radius
22-C3 of both bones

Assessment and Management

- Assess Airway, Breathing and Circulation and manage as necessary.
- Assess upper limb neurovascular function:
 - Sensory function: the median nerve supplies the thumb, index, middle and radial half of the ring finger on the palmar side of the hand and the tip of the thumb, index, middle and ring finger on the dorsum of the hand; the radial nerve supplies the dorsolateral aspect of the hand and the dorsal aspect of the thumb, index, middle and lateral half of the ring fingers; the ulnar nerve supplies the dorsal and palmar aspects of the medial half of the ring finger and the whole of the little finger.

- Motor function: test anterior interosseous branch of the median nerve by asking the patient to make the 'OK' sign (touching the tips of the first and second fingers with the thumb); test the radial nerve by asking the patient to extend their fingers or wrist against resistance; test the ulnar nerve by asking the patient to separate their fingers against resistance
- Vascular function: examine the radial (and ulnar) pulse. Assess capillary refill



- Examine the wrist, elbow and forearm for tenderness and range of motion.
- Perform a complete examination for other injuries.
- Immobilise the forearm and upper arm whilst waiting for X-ray.
- Provide analgesia.
- Immediate fracture reduction is required if there is neurovascular compromise, severe displacement or skin tenting.

Radial shaft fractures

Galeazzi fractures

- **Definition:** solitary fractures of the distal one third of the radius with accompanying subluxation or dislocation of the distal radioulnar joint (DRUJ). The synonym is reverse Monteggia's fracture.
- **Mechanism of injury:** commonly caused by a fall on to an extended, pronated wrist.
- **Presentation:** pain, swelling and deformity of the wrist and forearm. Tenderness and swelling at the distal radius and tenderness at the DRUJ.
- **Investigation:** X-ray the entire length of the forearm including wrist and elbow joints: AP and lateral views are usually

- **Management:** in adults, this requires surgical open reduction of the distal radius and DRUJ with internal fixation. In fracture can often be treated by closed reduction with traction and correction of radial angulation. General (GA) may be required in difficult cases. If closed reduction fails, K-wire insertion may be needed to lever the fracture position. Open reduction may be needed in some cases



Monteggia's fracture

- **Definition:** these are fractures of the proximal third of the ulna with associated dislocation of the radial head.
as:
 - Type I - fracture when anterior radial head dislocation. This is the common (60%).
 - Type II - fracture of the proximal ulna with posterior or dislocation of the radial head (15%).
 - Type III - fracture of the ulnar metaphysis with lateral or dislocation of the radial head (20%).
 - Type IV - fracture of both the radius and ulna at their proximal anterior dislocation of the radial head (5%).
- **Mechanism of injury:** usually caused by a fall on to an outstretched, extended and pronated elbow, or by a direct

- **Presentation:** acute, severe pain and swelling in the forearm and elbow. Damage may occur to the posterior interosseous
- **Investigation:** X-ray the entire length of the radius and ulna, including the wrist and elbow - AP and lateral views are sufficient but there may be a need for radiocapitellar views.
- **Management:** in adults, immobilise the joint in a splint and refer for open reduction and internal fixation.



Presentation

- Symptoms
 - gross deformity, pain, swelling
 - loss of forearm and hand function
- Physical exam
 - Inspection
 - open injuries
 - check for tense forearm compartments
 - Neurovascular exam
 - assess radial and ulnar pulses
 - document median, radial, and ulnar nerve function
 - Pain with passive stretch of digits
 - alert to impending or present compartment syndrome

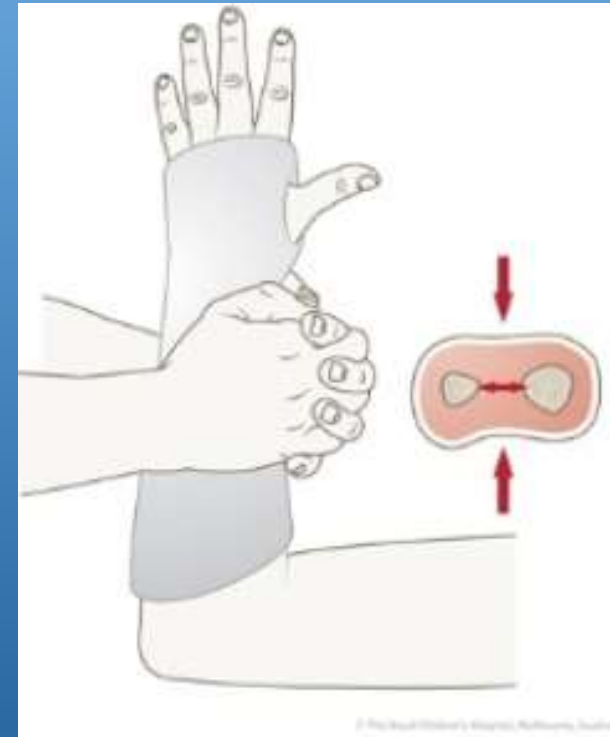
Imaging

- Radiographs
 - recommended views
 - AP and lateral views of the forearm
 - additional views
 - oblique forearm views for further fracture definition
 - ipsilateral wrist and elbow
 - to evaluate for associated fractures or dislocation
 - radial head must be aligned with the capitellum on all views

Treatment

- **Nonoperative**

- functional fx brace with good interosseous mold
 - indications
 - isolated nondisplaced or distal 2/3 ulna shaft fx (nightstick fx)
 - with < 50% displacement and
 - < 10° of angulation
 - outcomes
 - union rates > 96%
 - acceptable to fix surgically due to long time to union



- **Operative**

- ORIF without bone grafting

- indications

- displaced distal 2/3 isolated ulna fxs
 - proximal 1/3 isolated ulna fxs
 - all radial shaft fxs (even if nondisplaced)
 - both bone fxs
 - Gustillo I, II, and IIIa open fractures may be treated with primary ORIF

- outcomes

- most important variable in functional outcome is to restore the radial bow

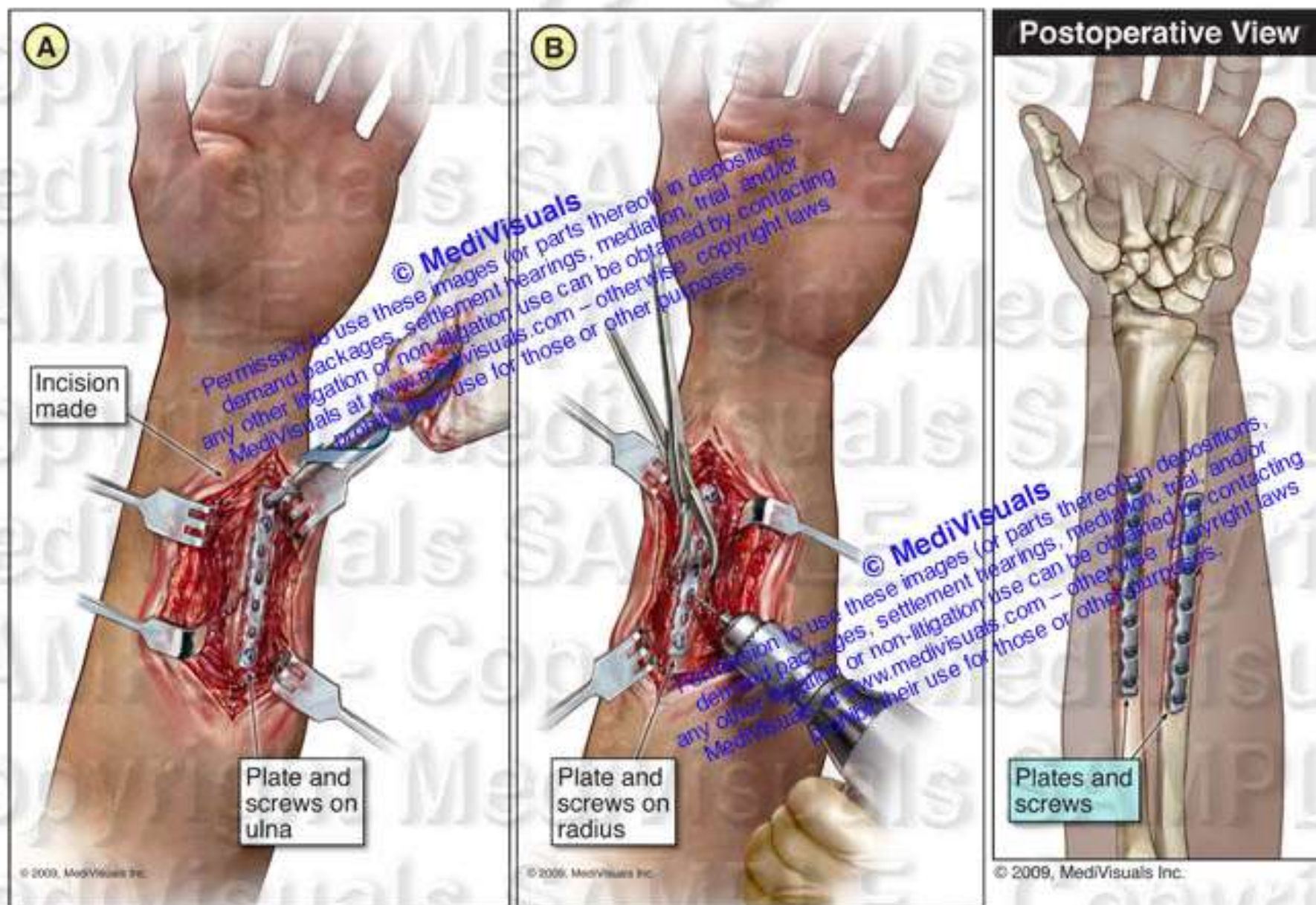
- ORIF with bone grafting

- indications

- cancellous autograft is indicated in radial and ulnar fractures with bone loss
 - bone loss that is segmental or associated with open injury
 - comminution >1/3 length of shaft
 - nonunions of the forearm

- External fixation
 - indications
 - Gustillo IIIb and IIIc open fractures
- IM nailing
 - indications
 - poor soft-tissue integrity
 - not preferred due to lack of rotational and axial stability and difficulty
 - maintaining radial bow (higher nonunion rate)

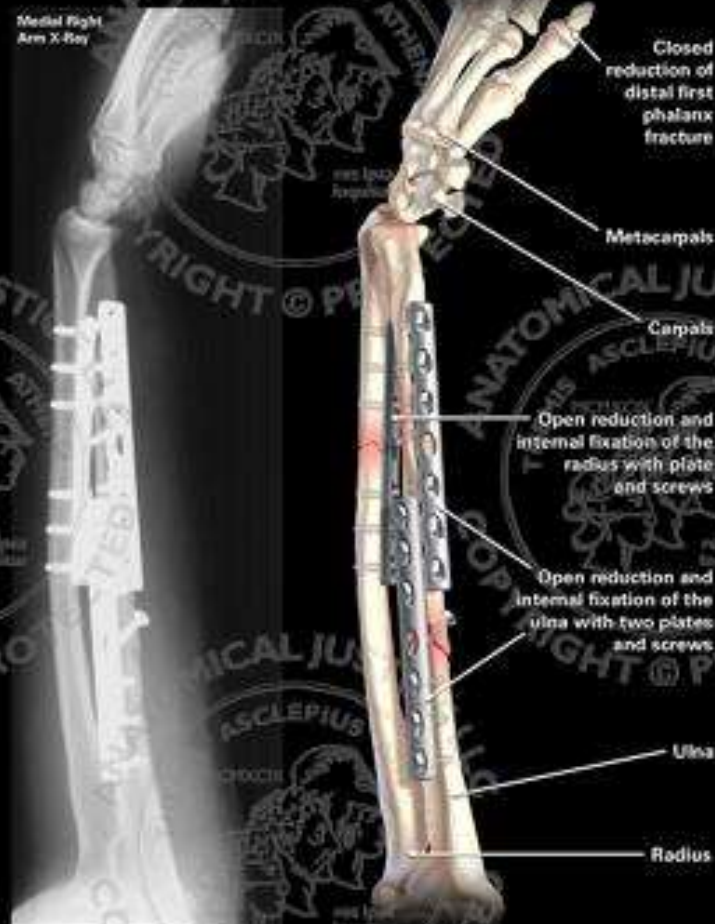
ORIF of Left Radius and Ulna Fractures



JANE DOE

Open Reduction and Internal Fixation of Right Arm Fractures

Medial View of the Right Arm



Palmar View of the Right Arm



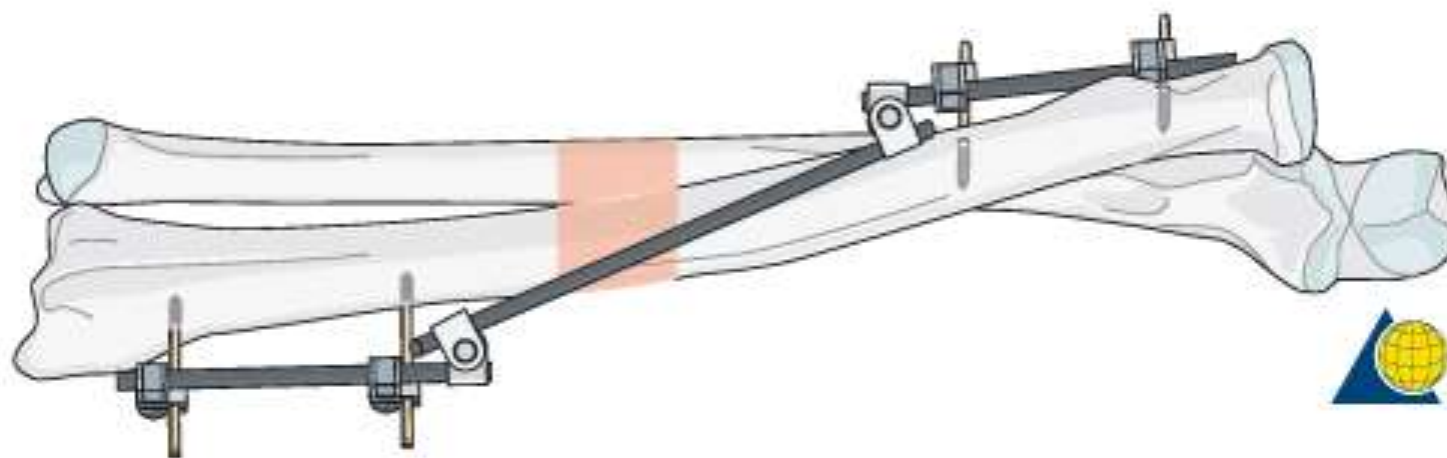
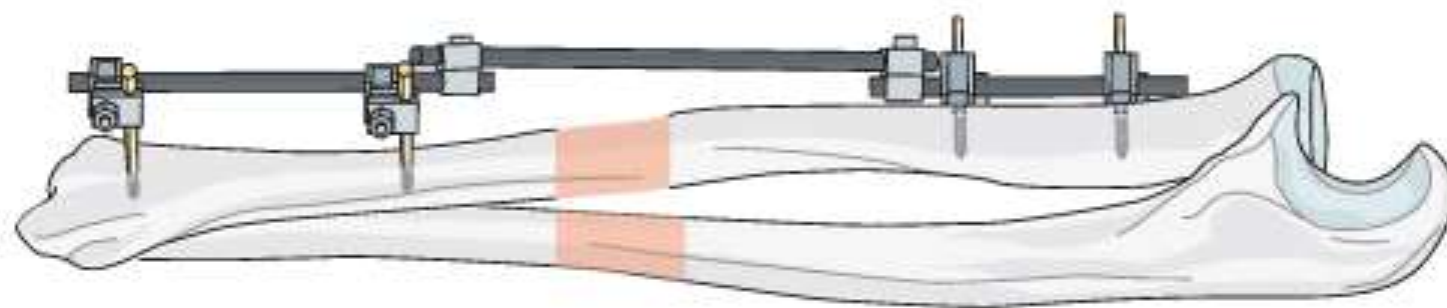


Figure 5. X-rays of a Monteggia fracture (A), reduction of the radius (B), and stabilization of the ulna (C) with elastic stable intramedullary nailing.



Image courtesy of Remedica Journals

<http://www.remedicajournals.com/Advances-in-Orthopaedics/BrowseIssues/Volume-1-Issue-2/Article-Intramedullary-Nailing-of-Pediatric-Long-Bone-Fractures>